bacteriology since Pasteur's "Etudes sur le Vin, le Vinaigre, et la Bière," the last of which was published in 1876, is Alfred Jörgensen's "Micro-organismen der Gährungsindustrie" (1886), of which the volume before us is an edited translation. This lack of text-books is doubtless in great measure due to the industrial aspects of micro-organisms having been comparatively neglected during the time that Pasteur, Koch, and their numerous disciples have been busily engaged in the investigation of questions of still more absorbing human interest. But whilst the great majority of bacteriologists have during this past decade been thus occupied in establishing or endeavouring to establish the connection between numerous diseases and specific organisms, a few more silent workers have been patiently engaged upon the less sensational though no less arduous task of placing the fermentation industries on a more scientific basis, adding in fact to the structure which had been commenced by Pasteur in his "Etudes" referred to above. The foremost in this field of research has unquestionably been Christian Hansen of the now world-famed Carlsberg Laboratory near Copenhagen, and to a concise and most lucid description of whose successful labours the present volume is chiefly devoted. The principal addition which has been made to our knowledge of the fermentation organisms by Hansen has been the precise characterization of a number of different "races" of yeast and the determination of the specific features of the fermentation induced by each particular race. Thus whilst Pasteur attributed the various diseases in wine and beer to the presence of organisms other than yeast, Hansen has shown that certain races of yeast itself are capable of bringing about most serious disturbances in the fermentation process. The lines on which Hansen has differentiated these several races of yeast, and the methods by which their pure culture may be effected are clearly though briefly described in this work, with which latest developments of brewing technology, both the author and translator have already identified themselves in the past.

The influence which has been exerted by the researches of Pasteur and Hansen on the practical conduct of the fermentation industries is quite analogous to that which has resulted in surgery from the investigations of Lister and Koch, in both cases the principle of rigid scientific cleanliness has become the order of the day. Thus we read, "the air in the fermenting-room may contain a world of germs which, in the fermentation industries, bring with them the most calamitous results; it is, however, possible to obtain air free from these invisible germs, and it admits of no doubt that, on the one hand, the purification of the air in the fermenting-room by passing it through a salt-water bath, and, on the other hand, the most rigidly executed order and cleanliness in the cellars of the Old Carlsberg brewery, stand in direct relation to the results."

From a practical point of view, the chief merit due to Hansen is that he has not only shown how pure growths of yeast may be obtained in the laboratory, but that he has further devised methods by which these pure cultures may actually be employed on the largest brewery scale. This brewing with pure yeast has already assumed very large dimensions on the Continent where a continually increasing number of breweries receive regular supplies of pure material. We have ourselves visited the laboratories of the Wissenschaftliche Stationen für Brauerei und Brennerei at Berlin and at Munich, and can testify to the impressiveness of witnessing the careful preparation on the manufacturing scale of different forms of pure yeast, each possessed of specific fermenting properties, which are then transmitted to various parts of Europe according to the special requirements of different breweries. These experimental brewing-stations, like so many other similar institutions on the Continent, are directly or indirectly subsidized by the State and number amongst their staff men of universal reputation in their particular departments. As we should anticipate, this method of scientific brewing with pure yeast has so far taken no root in this country, although we are glad to know that the translator, along with Mr. Horace Brown, has for some time past been engaged upon its experimental trial, and we learn from the latter in his introduction to this book "that, in a more or less modified form, pure yeast culture will play a very important part in the brewing of the future in this country."

This little work, which is condensed into 166 pages, and profusely illustrated and provided with an admirable bibliography, should receive the most careful attention from practical men, for whom it is mainly intended. Even the purely scientific student will find much in its pages that should prove of service to him.

PERCY F. FRANKLAND.

OUR BOOK SHELF.

An Epitome of the Synthetic Philosophy. By F. Howard Collins, with a Preface by Herbert Spencer. (London Williams and Norgate, 1889.)

THE aim and scope of this work cannot be more tersely or more accurately conveyed than by quoting *in extenso* the "compiler's preface."

"The object of this volume is to give in a condensed form the general principles of Mr. Herbert Spencer's Philosophy as far as possible in his original words. In order to carry out this intention each section (§) has been reduced, with but few exceptions, to one-tenth; the five thousand and more pages of the original being thus represented by a little over five hundred. The Epitome consequently represents 'The Synthetic Philosophy' as it would be seen through a diminishing glass: the original proportion holding between all its varied parts.

"Should this volume lead the general reader to a better acquaintance with Mr. Spencer's own works, I shall feel amply repaid for my labour.

"My warmest thanks are due to Mr. Spencer for his invaluable preface; and also to Miss Beatrice Potter, and Mr. Henry R. Tedder, F.S.A., the able and accomplished secretary and librarian of the Athenæum Club, for their valuable suggestions while the work has been in progress."

The desirability of such an undertaking, supposing it to have been successfully accomplished, is both manifest and manifold. Mr. Spencer's works are so voluminous that it is impossible to acquire a knowledge of his system of philosophy as a whole without devoting to it an expenditure of time which is practically impossible for most men who are not specially engaged in philosophic studies. Moreover, even to a reader who is thus specially engaged, and who therefore desires fully to master this system, no small difficulty is experienced from the fact that hitherto there has not been so much as an index to guide his

©1890 Nature Publishing Group

studies through these reams and reams of paper. Consequently, the first class of readers have hitherto for the most part been satisfied to gain their knowledge of Spencer through the "Cosmic Philosophy" of Fiske, while the latter class have experienced a hitherto hopeless difficulty in refreshing their memories upon particular points, or in finding passages to which they may wish to refer in publications of their own. Speaking for ourselves, we are conscious of often having done a negative injustice to Mr. Spencer on this account, simply because, in order to avoid the possibility of any positive injustice in the way of misrepresentation, we have deemed it wisest not to allude to him at all.

Now, the epitome which Mr. Howard Collins has supplied so admirably satisfies all the requirements of the case that henceforth the general reader will be able to acquire a clear knowledge of Mr. Herbert Spencer's philosophy in one-tenth of the time that it has hitherto been necessary to expend, while—as Mr. Spencer himself observes in his highly commendatory preface—more serious students will find that "a clear preliminary conception is more readily obtained from a small outline-map than from a large one full of details." Lastly, for all purposes of reference, this epitome leaves nothing to be desired; for not only does it run parallel with the original—chapter by chapter and section by section—but it is also furnished at the end with an alphabetical index of subject-matter: so that, if a man is writing upon any of the innumerable topics which Mr. Spencer has handled, he can immediately ascertain all that Mr. Spencer has said with regard to them.

For these reasons we cordially recommend this most painstaking epitome to every class of readers; and we cannot doubt that its publication will greatly promote the diffusion of Mr. Spencer's thought in all the English-speaking communities of the world.

G. J. R.

The Earth and its Story. Edited by Robert Brown, Ph.D., F.L.S. (London: Cassell and Co., 1889.)

THE continued publication of good and popularly written scientific works is one of the most gratifying signs of the times; it testifies, in no uncertain manner, to the growth of a taste for scientific knowledge in the mind of the general public, and hence is a matter of congratulation.

Of all the sciences none may perhaps be made more interesting than physical geography, or its modern equivalent physiography. The desire to know something about the earth's position in the universe, its formation, and its inhabitants, is and always has been innate in man, and we are glad, therefore, to welcome works that may satisfy this craving after light. The one before us deals in a comprehensive manner with the geographical distribution of plants and animals, and the agents concerned in their dispersion; with the physics of the sea, waves, currents, and tides; with terrestrial magnetism; climate and the causes affecting its distribution; rainfall and precipitation in general. A considerable amount of space is given to descriptions of geological formations and the fossils they contain, whilst ideal landscapes with restored animals are plentifully figured. We regret, however, that only a very meagre description is given of the earth as a planet. It must be remembered that astronomy is a very important part of physiography, even when looked at from a utilitarian point of view. The reason why the movements of the heavenly bodies have been studied from time immemorial is that a knowledge of them was necessary in order to meet the vicissitudes of life, and even before primitive man had inquired into the constitution of the earth he had arrived at crude conceptions as to the constitution of the universe from uncritical observations of celestial phenomena. The priority of these conceptions demonstrates their importance, and therefore, in a work intending to convey earth knowledge, the verification of the earth's rotation and revolution and the determination of its true size and shape should certainly be included. The measurements of arcs of meridian, whereby the exact size and shape of the earth may be found, are easy to describe, and preferable to the proofs of the earth's rotundity known in the time of Peate; besides which, such investigations essentially belong to physical geography. But, excepting these omissions, the work is one of sterling value; it is profusely illustrated, each of the two volumes containing twelve coloured plates and about 270 woodcuts, and the explanatory text is very readable and interesting throughout. Such a production will naturally gravitate to the free public libraries and similar institutions, and will be of great use in extending scientific knowledge.

Steam. By William Ripper, Professor of Mechanical Engineering in the Sheffield Technical School. (London: Longmans, Green, and Co., 1889.)

THIS volume consists of an elaboration of notes of lectures given by the author to an evening class of young mechanical engineers. For its size, it contains much useful information; and the simplicity of expression, and the absence of elaborate calculation, throughout the chapters help to make it suitable for elementary classes. The author gives special prominence to the principles involved in the economical use of steam. This part of the book is particularly lucid and concise, being perfectly clear to the average student. He also describes well the compound, triple, and quadruple expansion engines, especially dealing with the general idea of the expansion and course of the steam through the cylinders on its way to the condenser, as well as with the general laws regulating the volumes of the cylinders. Although the subject is treated in an elementary manner, there is much sound work in the book. Text-books on steam have greatly improved of late years from an engineer's point of view, and the present volume is a good example of the way in which the subject should be handled for the benefit of budding engineers.

The illustrations and diagrams are good, the former being taken from engines in actual practice. Fig. 134, however, does not represent particularly good practice. The flat crown of the fire-box of locomotive type of marine boilers is probably seldom stayed after the manner shown; the crown stays being generally screwed through the shell of the boiler, and either rivetted over or fastened with a nut and a copper washer. Assuming that these stays are screwed through the fire-box crown sheet, it would be interesting to know how the author proposes to place them in position, as shown in the figure. Fig. 137 represents a Ramsbottom locomotive safety valve. Although correct in principle, it is quite a curiosity in point of design, the valve in general use being very different in appearance, as the reader may observe by referring to the one shown on the locomotive boiler illustrated in Fig. 132. We may say in conclusion that a fuller index would have added considerably to the value of the book.

N. J. L.

Australia Twice Traversed. By Ernest Giles. In Two Vols. (London: Sampson Low and Co., 1889.)

THE narrative presented in these volumes has been compiled by Mr. Giles from the journals written by him during five exploring expeditions into and through central South Australia and Western Australia from 1872 to 1876. The materials of the book are not, therefore, very fresh, but this ought not to detract much from their interest, as hitherto only fragmentary accounts of Mr. Giles's travels have been printed. It must be admitted that records of wanderings in the interior of Australia are not usually very fascinating. Mr. Lumholtz's book, which we lately reviewed, is a brilliant exception to the general rule. We cannot say that Mr. Giles's work rises to an equal height above the ordinary level; for it lacks that fine insight into

©1890 Nature Publishing Group